Restoring Vision in Adverse Weather Conditions With Patch-Based Denoising Diffusion Models

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Abstract

Image restoration under adverse weather conditions has been of significant interest for various computer vision applications. Recent successful methods rely on the current progress in deep neural network architectural designs (e.g., with vision transformers). Motivated by the recent progress achieved with state-of-the-art conditional generative models, we present a novel patch-based image restoration algorithm based on denoising diffusion probabilistic models. Our patch-based diffusion modeling approach enables size-agnostic image restoration by using a guided denoising process with smoothed noise estimates across overlapping patches during inference. We empirically evaluate our model on benchmark datasets for image desnowing, combined deraining and dehazing, and raindrop removal. We demonstrate our approach to achieve state-of-the-art performances on both weather-specific and multi-weather image restoration, and experimentally show strong generalization to real-world test images.